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THE KARYOTYPE OF *EXILIBOA PLACATA* BOGERT (TROPIDOPHEIDAE), AND COMPARISONS WITH THE FAMILY BOIDAE (REPTILIA: SERPENTES)

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Abstract.—The first karyotype for any member of the Tropidopheidae is described from one male and one female of the dwarf boa, *Exiliboa placata* Bogert, from Oaxaca. The diploid number is 36, composed of 16 macrochromosomes and 20 microchromosomes. A possible secondary constriction is present on the second pair of macrochromosomes, and this constitutes the only distinctive difference between this species and some members of the Boidae. The significance of possible differences in centromere positions between *Exiliboa* and boids with 36 chromosomes is unknown.

The Tropidopheidae includes four genera according to several recent authors (Underwood 1976, McDowell 1987): *Tropidophis* (15 species), *Trachyboa* (2 species), *Ungaliophis* (2 species), and *Exiliboa* (monotypic). Nothing is known of the chromosome morphology for any member of the family. This paper reports the karyotype of the monotypic genus *Exiliboa.*

Two specimens of *Exiliboa placata* Bogert were available for study: an adult female (UTA R-4731) and an adult male (UTA R-4732). These specimens were collected by Jonathan A. Campbell at 7.1 mi. (UTA R-4731) and 6.5 mi. (UTA R-4732), respectively, north of the crest of Cerro Pelón, Oaxaca, México, on 28 June 1975.

Chromosomes were prepared by the hypotonic citrate method of Patton (1967), using the modification by Cole & Leavens (1971). Velban was used instead of colchicine. Each macrochromosome was measured (to the closest 0.01 mm) with dial calipers directly on the 4×5" negative. Chromosome terminology follows Cole (1970). The arrangement of the chromosomes within the karyotype is based on size, from the largest pair (number one) to the smallest. In addition to the karyotypes presented (Figs. 1, 2), I subjected the measurements of the best 19 cells (seven cells from the female and twelve cells from the male) to computer analysis using the program Karypak (ver. 1.0) by William H. LeGrande (pers. comm.). The macrochromosome means were calculated from each arm of each chromatid. In this analysis only macrochromosomes were measured and, for purposes of the karyotype percentages and arm ratio (centromeric index) estimations, they were treated as the entire complement (i.e., microchromosomes were not included as part of the karyotype). This process does not allow for the detection of differences among the microchromosomes nor for the contribution of the microchromosomes to the entire karyotype. However, for most snakes such information on the microchromosomes is rarely available and any differences in size are suspect, in most cases, because of the small sizes and poor resolution. Therefore, omission of the microchromosomes is practically the same as assignment of a constant. I believe that this approach is most effective and reasonable for the critical examination of the macrochromosomes. Since no sexual dimorphism was detected, the male cells were combined with the female cells for the construction of the composite idiogram (Fig. 3).

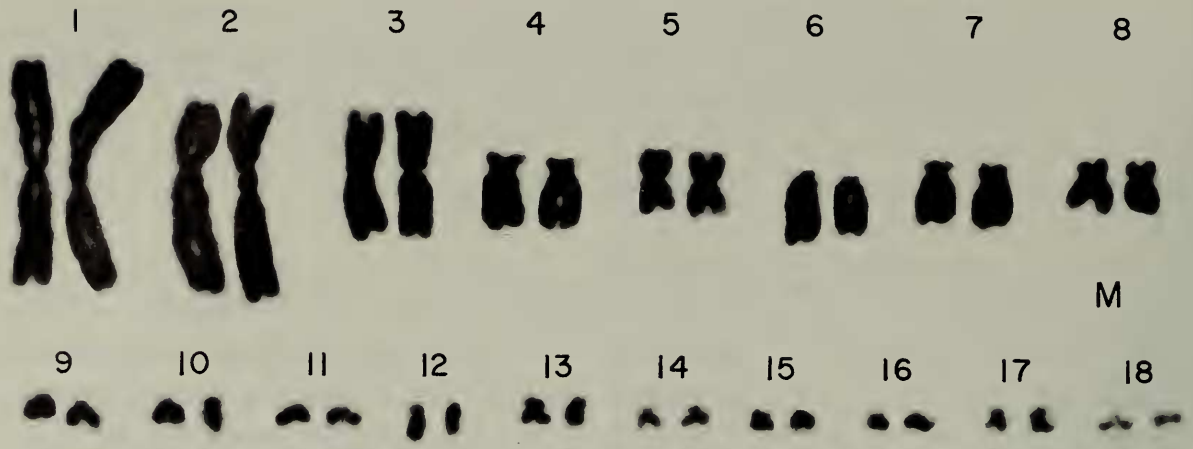

Fig. 1. Karyotype of an adult male *Exiliboa placata* (UTA R-4732), 2n = 36.

Fifteen cells each from the male and the female were photographed. The karyotype consists of eight pairs of macrochromosomes and ten pairs of microchromosomes for a diploid number of 36 (Figs. 1, 2). The fundamental number is 56 (30 from macrochromosomes and 26 from microchromosomes). The largest macrochromosome pair is metacentric, the second largest pair is submetacentric, and pair three is metacentric. These three pairs are clearly distinguishable from all of the other chromosomes. Pairs four and seven are subtelocentric and similar in morphology, but pair seven is slightly smaller and the short arms are slightly longer (proportionally; Table 1) than the short arms of pair four. Pair five is metacentric, pair six is telocentric, and pair eight is submetacentric. All of the macrochromosomes are easily distinguishable from each other and from all of the microchromosomes (Fig. 3). At least three pairs of the microchromosomes appear to be bi-armed; the remainder appear to be telocentric, or nearly so. No morphologically distinguishable sex chromosomes are apparent; however, pair five is probably homologous to the ZZ sex chromosomes because it is the only pair of metacentric macrochromosomes that is approximately the same size as the ZZ sex chromosomes identified in members of the Boidae by other workers (Mengden & Stock 1980). All other macrochromosomes of *Exiliboa* are distinctly different in centromere position or in size.

Comparisons with the Boidae.—All species of the Boidae for which karyotypes are known have 36 chromosomes (2n) ex-

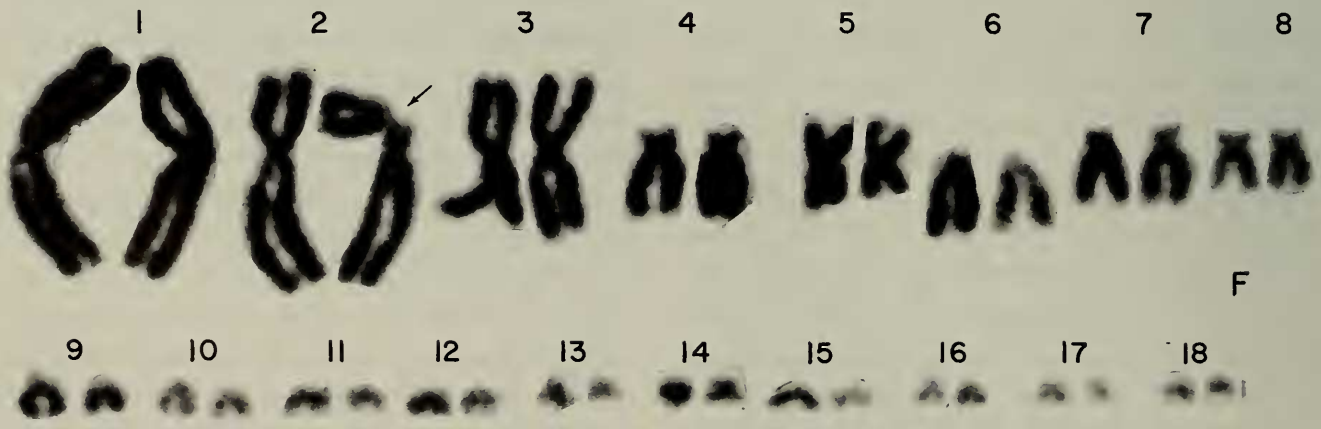

Fig. 2. Karyotype of an adult female *Exiliboa placata* (UTA R-4731), 2n = 36. The arrow indicates a possible secondary constriction.

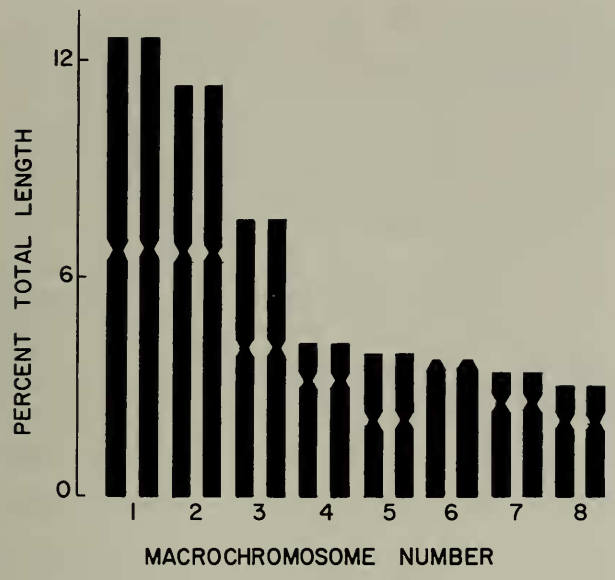

Fig. 3. Composite idiogram of the macrochromosomes of *Exiliboa placata,* based on mean measurements and arm ratios from 19 cells. Percent total length is calculated from the total length of the macrochromosomes in each cell, excluding the ten pairs of microchromosomes. Macrochromosome number is the pair number.

Table 1.—A comparison of the macrochromosomes of *Exiliboa placata,* both sexes combined; n = 19. Percent of total is the percent of the total length (in mm, measured from the 4 × 5″ negatives) of macrochromosomes, excluding the microchromosomes.

Pair number	Arm lengths			Percent of total	Centromere position
	Short	Long	Ratio		
1	12.2	14.3	1.17	12.62	Metacentric
2	9.6	14.1	1.47	11.29	Submetacentric
3	7.5	8.5	1.13	7.62	Metacentric
4	2.1	6.8	3.24	4.24	Subtelocentric
5	4.0	4.4	1.10	4.00	Metacentric
6	0.0	7.8	0.00	3.71	Telocentric
7	1.8	5.5	3.06	3.48	Subtelocentric
8	2.1	4.3	2.05	3.05	Submetacentric

cept *Sanzinia madagascarensis* (Branch 1980), *Acrantophis dumerili* (Mengden & Stock 1980), *Eryx johni* (Singh et al. 1968), and *Gonglyophis conicus* (Singh et al. 1970), all with 34, *Corallus caninus* with 44 (Beçak 1965), and *C. enhydris* with 40 (Gorman & Gress 1970).

Diploid numbers other than 36 among boids probably represent derived conditions since 36 is the modal number for known boids and is also represented in the primitive *Boa* (McDowell 1979). In *Sanzinia madagascarensis* there are nine pairs of macrochromosomes, including an extra metacentric (pair four in Mengden & Stock 1980:fig. 10), but only eight pairs of microchromosomes, versus ten in *Exiliboa. Acrantophis dumerili* differs from *Exiliboa* by having only nine pairs of microchromosomes; the macrochromosomes appear indistinguishable except for the telocentric W chromosome in *Acrantophis* (Mengden & Stock 1980). *Eryx johni* differs from *Exiliboa* by having pair eight telocentric, not submetacentric, and by having only nine pairs of microchromosomes, all of which are telocentric (Singh et al. 1968); at least three pairs of microchromosomes in *Exiliboa* are bi-armed. The species of *Corallus* have telocentric macrochromosomes, probably due to centric fission of the first two (*C. enhydris*) or four (*C. caninus*) macrochromosomes. *Gonglyophis conicus* has one fewer microchromosome (2n = 34; Singh et al. 1970).

All of the remaining boids for which chromosome morphology is known have diploid numbers of 36. The macrochromosomes of *Exiliboa placata* are similar to those reported for *Liasis* by Mengden & Stock (1980) except that pair six of *Exiliboa* is clearly telocentric and distinguishable from all other pairs, whereas pairs six, seven, and eight of *Liasis* are telocentric; Mengden & Stock (1980) also identified pair five as ZZ of the sex chromosomes. *Python molurus* differs from *Exiliboa* only in the arm ratios of some macrochromosomes (Singh et al. 1968). The karyotype of *Xenopeltis unicolor* (sometimes included in the Boidae) is similar to *Exiliboa* in number and morphology of chromosomes except that pairs four, seven, and eight have longer short arms than do the apparent homologues in *Xenopeltis* (Cole & Dowling 1970). Also similar in number and morphology is *Loxocemus bicolor* (Fischman et al. 1972). In *Charina bottae*

and *Lichanura roseofusca* the karyotypes (Gorman & Gress 1970) are extremely similar to *Exiliboa* except that the telocentric macrochromosome (pair six in *Exiliboa*) appears homologous to the smallest macrochromosome pair in *Charina* and *Lichanura* and pairs five through seven in *Charina* and *Lichanura* are telocentric rather than subtelocentric (pairs four and seven) or even submetacentric (pair eight) as in *Exiliboa.* The microchromosome morphology was not given by Gorman & Gress (1970) although they did report a fundamental number of 44, which only would result from all of the microchromosomes being treated as telocentric. *Eunectes murinus, Epicrates cenchria,* and *Boa constrictor* differ from *Exiliboa* mainly by having relatively shorter short arms on macrochromosomes four (pair five in Beçak 1965:figs. 1–12), seven, and eight (Beçak 1965). Examination of additional tropidopheids is necessary to determine the significance of the above differences.

Even though heteromorphic sex chromosomes are not evident in *Exiliboa,* pair five is probably homologous to the ZZ sex chromosomes identified in some boids (*Acrantophis* and *Liasis* by Mengden & Stock 1980). The lack of apparent difference among the cells studied here suggests that the W sex chromosome has undergone little, if any, morphological change if homomorphic sex chromosomes are primitive in snakes (Beçak et al. 1966). This supports the position that *Exiliboa* is relatively primitive, among snakes in general, and its close relationship to the boids is not unreasonable.

In at least five (three from the male, two from the female) of the photographs of *Exiliboa* chromosomes there is a consistent discontinuity in the basal part of the short arm of chromosome pair two (Fig. 2). That discontinuity is possibly a secondary constriction; if so, it is the first reported for any member of either the Tropidopheidae or the Boidae.

The karyotype of *Exiliboa placata* is not distinctively different from several species of the Boidae, nor is it distinctive from several non-boids (i.e., *Xenopeltis* in the Xenopeltidae [Cole & Dowling 1970]; several colubrids, except for heteromorphic sex chromosomes in some colubrids). However, consistent differences in centromere positions (i.e., pairs 4, 7, and 8 with longer short arms in *Exiliboa*) might exist between *Exiliboa* and some boids with 36 chromosomes. Based on the karyotype alone, the evolutionary relationships of *Exiliboa* within the Tropidopheidae and the separation of the Tropidopheidae from the Boidae is neither refuted nor supported.

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